

Pre-Rulemaking Public Meeting to Discuss 2018 LCFS Preliminary Draft Regulatory Amendment Text



INDUSTRIAL STRATEGIES DIVISION
TRANSPORTATION FUELS BRANCH
NOVEMBER 6, 2017
SACRAMENTO, CA

Meeting Participation

-
- Posted materials can be found on the LCFS Meetings webpage
 - https://www.arb.ca.gov/fuels/lcfs/lcfs_meetings/lcfs_meetings.htm
 - Watch and listen via the Webcast:
 - <https://video.calepa.ca.gov/>
 - Ask questions or provide feedback during the working meeting
 - Email sierrarm@calepa.ca.gov.
 - Participate via conference call
 - Toll Free: 888-566-5916
 - Toll/Outside the United States: 1-773-756-4816
 - Participant Code: 9886883
 - Feedback should be sent to:
 - LCFSworkshop@arb.ca.gov by **December 4, 2017**



Agenda Outline

- Potential Amendments to the Low Carbon Fuel Standard:
 - Protocol for carbon capture and sequestration projects
 - Buffer accounts and updates to credit provisions
 - Renewable electricity and hydrogen
 - Updates to lifecycle analysis modeling tools and related pathway issues
 - Crediting provisions for refineries
- Miscellaneous updates
- Rulemaking Timeline
- Next Steps
- Open Discussion



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Supporting Information and Draft Materials

- Draft CCS Protocol
- Draft CA-GREET3.0
- Draft Lookup Table Pathway Documents
- Updated Draft Simplified CI calculators and their respective Tier 1 Manuals
 - Corn Ethanol
 - Sugar Ethanol
 - Biodiesel and Renewable Diesel
 - Landfill Gas to RNG
- New Preliminary Draft Regulatory language, including
 - Carbon Intensity Benchmarks
 - Lookup and Temporary Fuel Pathway Tables
 - Other segments related to today's discussion topics

Posted materials can be found on the LCFS Meetings webpage
https://www.arb.ca.gov/fuels/lcfs/lcfs_meetings/lcfs_meetings.htm



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Accounting and Permanence Protocol for Carbon Capture and Geologic Sequestration under the LCFS (CCS Protocol)

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CCS Discussion Outline

- Background
- Review Preliminary Draft of CCS Protocol
 - CCS Permanence Requirements
 - CCS Accounting Requirements
- Open Discussion



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Background

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Potential for CCS in California

- CO₂ storage potential in CA
 - 30–420 Gigatonne onshore formation capacity (California Geological Survey, 2011)
 - Offshore sub-seabed offers additional capacity



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2018 LCFS Amendments for CCS

- Existing provisions for potential CCS generation of LCFS credits:
 - Refinery investment credits
 - Innovative crude production credits, and
 - Provisions for fuel pathways
- Staff is **considering proposing** to include provisions for crediting direct air capture CCS projects



CCS Projects in LCFS

- Credits go to capture facility
- Current proposal: storage facility must be co-applicant
- Capture and storage facilities do not need to be co-located
- Must comply with CCS protocol
- No credits issued until CCS Protocol is approved and project meets all protocol requirements



Lessons Learned from Underground Natural Gas Storage Leaks

- High quality site selection that minimizes leakage risk is important
- Well integrity requirements need to be strong
- Rigorous monitoring is necessary
- Best practices need to be followed
 - DOE's National Energy Technology Lab published several best practice manuals



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Draft CCS Protocol is Available

- Draft CCS Protocol made available publically (including accounting and permanence requirements)
https://www.arb.ca.gov/fuels/lcfs/lcfs_meetings/lcfs_meetings.htm
- CCS Protocol anticipated to be proposed to be incorporated into the LCFS as part of 2018 amendment rulemaking
- Staff continues to refine the CCS Protocol



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CCS Permanence Requirements

General Process for CCS Protocol Adoption and Implementation

CCS protocol (includes accounting and permanence requirements)



LCFS amendment (incorporates CCS protocol by reference)



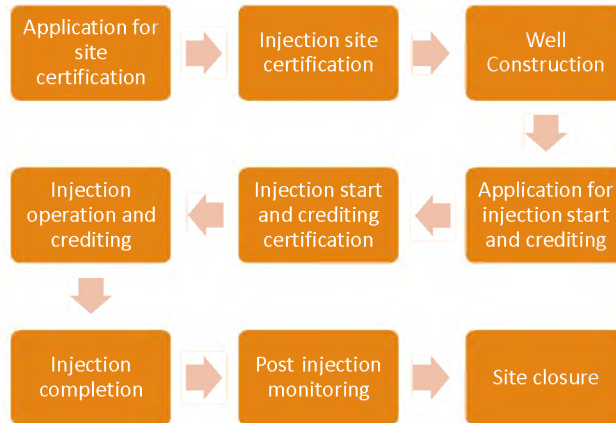
Project application pursuant to CCS protocol and LCFS



Project crediting



Project Process Under CCS Protocol



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Overall Permanence Requirements

- Permanence certification
 - Sequestration site certification
 - Injection start and crediting certification
- Well construction
- Operating requirements
- Monitoring requirements
- Financial, post-injection, and other requirements



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Permanence Certification

- Application for sequestration site certification
 - Includes site characterization
 - Includes all necessary plans (e.g. well construction, monitoring, financial instruments, emergency response)
 - Must be reviewed by third-party, independent, professional geologist prior to submittal
- CARB certification of sequestration site
- Application for injection start and crediting
 - Submitted after well construction
 - Must be reviewed by third-party, independent, professional petroleum engineer prior to submittal
- CARB certification for crediting of injected CO₂



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Site Characterization: Focus Areas

- Minimum site selection criteria
- Site-based risk assessment and demonstration of low risk
- Geologic and hydrogeologic evaluation of the proposed site
- Area of review delineation
- Corrective action requirements
- Baseline surface and near-surface measurement



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Site Characterization: Minimum Site Selection Criteria

- Sequestration reservoir:
 - Sufficient areal extent, thickness, porosity, permeability, and injectivity
- Minimum injection depth:
 - 800 m (~2,600 ft)
- Primary confining layer:
 - Free of transmissive faults or fractures and of sufficient areal extent, integrity, thickness, and ductility



Site Characterization: Minimum Site Selection Criteria (*continued*)

- Dissipation intervals above the storage complex
 - At least one permeable stratum and a secondary confining layer above storage complex
- Dissipation interval(s) below the storage complex
 - CARB may require this to lower the potential for induced seismicity



Site Characterization: Site-based Risk Assessment

- Site-based risk assessment demonstrates that the site is appropriate for sequestration:
 - Evaluation of potential pathways for CO₂ leaks or migration
 - Classification of risk probability and consequence, accompanied by a sufficient explanation
- Risk management plan required
- If any risk scenarios show high probability of occurrence and high magnitude of adverse impacts, then risks must be mitigated prior to CARB approval



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Site Characterization: Geologic and Hydrogeologic Evaluation

- Protocol requires each site to undergo a geologic study to show that all minimum site selection requirements are met
- Existing site characterization data can be used to fulfill the site characterization requirements if sufficient
- Protocol establishes formation and well testing requirements



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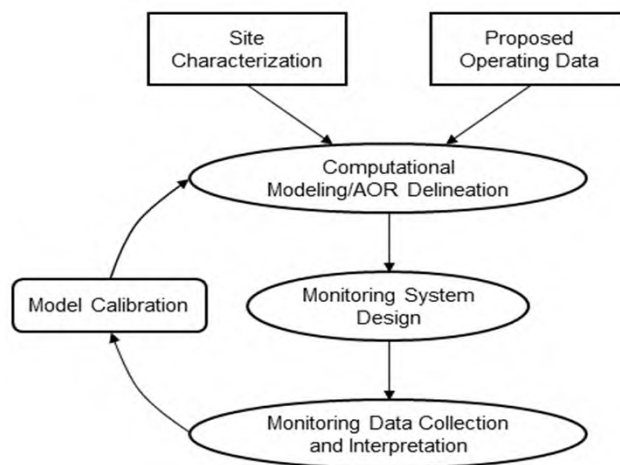
Site Characterization: Area of Review (AOR) and Corrective Action

- AOR encompasses:
 - The region overlying the free phase CO₂ plume, and
 - The CO₂ pressure front
- AOR and corrective action requirements ensure:
 - Potentially impacted areas are delineated,
 - Wells receive corrective action when appropriate, and
 - The AOR is updated as conditions warrant
- The protocol sets forth the AOR and corrective action requirements



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Site Characterization: Relationship Between Activities



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Site Characterization: Baseline Surface and Near-surface Measurement

- Baseline monitoring and data collection
 - A minimum of 1 year prior to injection
- Properties that affect baseline data must be evaluated:
 - Soil type, soil organic carbon, vegetation type/density
- Repeated measurements at several fixed sites
 - Capture seasonal or diurnal variations
- Sample locations must represent
 - A reasonable grid size and potential point sources



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Well Construction: General Requirements

- Must prevent movement of fluids into or between any unauthorized zones
- Must permit continuous pressure monitoring
- Well materials must be compatible with injection and formation fluids



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Well Construction: General Requirements (*continued*)

- Surface casing must:
 - Extend through base of lowermost freshwater aquifer
- One long string casing must extend from surface to the injection zone
- All casing must be cemented to the surface



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Well Construction: Pre-injection Testing Requirements

- Logs, surveys, and tests during drilling and construction of wells
- Core samples of sequestration zone and confining layers
- Representative samples of sequestration zone formation fluids
- Required Tests:
 - Pressure fall-off, pump, and injectivity
- Must provide CARB with the opportunity to witness all logging and testing activities



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Operating Requirements: General

- Injection pressure must not:
 - Exceed 90% of the fracture pressure of the injection zone
 - Initiate fractures in the confining layer
- Mechanical integrity in the injection well must be maintained at all times



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Operating Requirements: Required Shutdowns

- When loss of well mechanical integrity is suspected, operator must immediately and quickly investigate the cause
- If investigation and monitoring indicate that the well lacks mechanical integrity:
 - Immediately cease injection
 - Restore and demonstrate mechanical integrity
 - Obtain CARB approval prior to resuming injection



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Monitoring Requirements: Testing and Monitoring Plan

- CARB approved Testing and Monitoring Plan is required, which must include:
 - Continuous monitoring of wells during injection
 - Pressure, injection rate, and volume
 - Quarterly corrosion monitoring
 - Mechanical integrity testing
 - Project monitoring during injection
 - Emissions
 - Verification of containment



Monitoring Requirements: Mechanical Integrity Testing

- General requirements on mechanical integrity testing:
 - Perform testing to demonstrate mechanical integrity of wells annually
 - Casing wall thickness and integrity must be inspected at least once every 24 months
 - CARB may request the operator demonstrate mechanical integrity



Monitoring Requirements: Containment Monitoring

- Plume tracking
 - Pressure front
 - Free-phase CO₂ plume
- Surface and near-surface monitoring
 - Surface air monitoring of point and other targeted sources to quantify CO₂ or other gases (e.g. CH₄)
 - Soil vapor monitoring of the vadose zone
 - Annual vegetation surveys to monitor ecosystem stress



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Monitoring Requirements: Seismicity

- Deploy and maintain downhole seismic monitoring system
- Continuously monitor any induced microseismic activity
- Continuously monitor for earthquakes of magnitude 2.7 or greater within a radius of 1 mile
 - Notify CARB when an earthquake occurs
 - Implement the Emergency Remedial Response Plan If:
 - An earthquake has caused a failure of the mechanical integrity of wells, facility, or pipeline



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Financial, Post-injection, and Other Requirements: Well Plugging

- A Well Plugging Plan is required
 - Prior to well plugging, the operator must determine bottomhole pressure and perform a final mechanical integrity test
- Written approval from CARB is required before plugging wells
- Within 24 months after injection completion, operator must plug and abandon injection wells (and production wells, if applicable), unless approved otherwise by CARB



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Financial, Post-injection, and Other Requirements: Post-injection Requirements

- A CARB approved Post-Injection Site Care and Site Closure Plan is required
- Monitor the position of the free-phase CO₂ plume and pressure front
- Monitoring for at least 15 years after injection completion and until plume stability occurs:
 - Continuous monitoring at monitoring wells
 - Periodic 3D seismic surveys at 1, 3, 5, and every subsequent 5 years after injection completion
 - Determine if leaks have occurred, if the plume is stable, and if remedial action is required



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Financial, Post-injection, and Other Requirements: Post-injection Requirements (contd)

- Once monitoring and modeling shows plume stability has occurred
 - Must plug and abandon monitoring wells
- For 100 years post-injection
 - Must demonstrate that no fluids are leaking out of the sequestration zone
 - Annual leak detection testing at each well within AOR at wellhead, and near well surface
- After 100 years, site closure can occur



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Financial, Post-injection, and Other Requirements: Site Closure

- After CARB site closure authorization:
 - Notify authorities to impose appropriate conditions on subsequent drilling
 - Record deed notation, or any other title search document, to inform buyers of property land use history:
 - Land was used to sequester CO₂
 - State agency and local authority with which further information is filed
 - Fluid volume injected, the sequestration zone, and period over which injection occurred



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Financial, Post-injection, and Other Requirements: Financial Requirements

- Must demonstrate and maintain financial responsibility and resources using CARB-approved financial responsibility instrument
 - Trust funds, surety bonds, letters of credit, insurance, self-insurance, or escrow accounts
- Must maintain financial responsibility and resources until CARB approves site closure
- Must demonstrate sufficient funds to cover the cost of:
 - Corrective action on wells in the AOR
 - Well plugging, post-injection site care and site closure
 - Emergency and remedial response



CCS Accounting Requirements

Introduction

- Sets framework for quantifying GHG emissions reductions from carbon capture and sequestration under LCFS
- Applicable to CCS projects that capture CO₂ and sequester CO₂ in:
 - CO₂-EOR reservoirs
 - Saline formations and
 - Depleted oil and gas reservoirs without oil and gas recovery
- Covers any capture methods as long as CO₂ is geologically sequestered
 - Includes Direct Air Capture



Overview

- Designed to fit the LCFS GHG quantification framework
- Covers lifecycle GHG emissions
- Fits into fuel pathway CI determination for CCS projects involving alternative fuel production

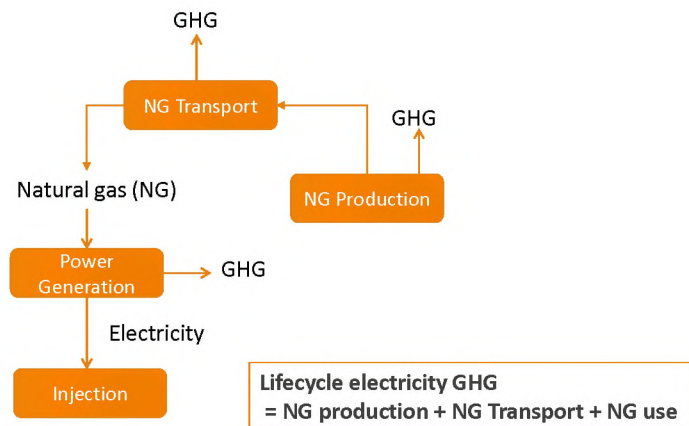


Major Considerations

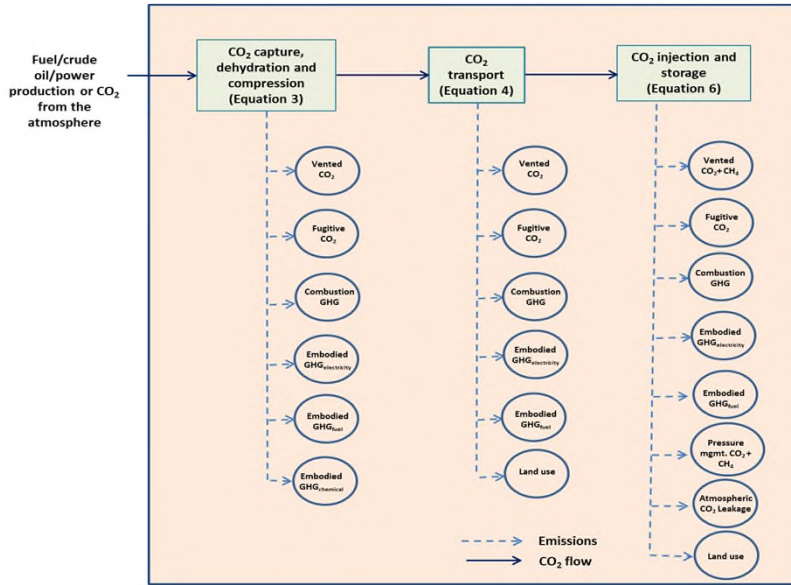
- Accounts for emissions during oil or brine production and CO₂ recycling processes
- Using detection limit to discount for possibility of small leaks that are below the detection limit



Lifecycle Concept: Electricity Used in Injection as Example

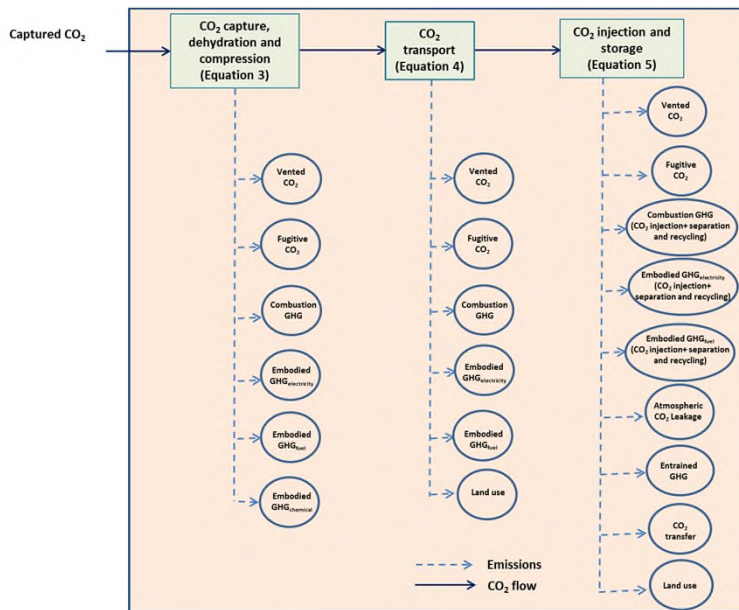


System Boundary: Storage in Saline Formations



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System Boundary: Storage in CO₂-EOR Reservoirs



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Conceptual Design

$$\text{CCS Credit} = \text{CO}_2 \text{ Injected} - \text{Project GHG emissions}$$

Where,

$$\text{Project GHG emissions} = \text{Capture GHG} + \text{Transport GHG} + \text{Injection GHG} + \text{Land use change}$$



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Description of Project Component GHG Emissions

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GHG Emissions from Carbon Capture, Dehydration, and Compression

- Incorporates life cycle GHG emissions for:
 - Fuel and electricity use. Sum of upstream (embodied) emissions and on-site fuel combustion
 - Chemical use
- Incorporates vented and fugitive CO₂ emissions
 - Event-based approach for vented CO₂ emissions & and equipment count method for fugitive CO₂ emissions
 - Alternative: Staff seeks feedback on the reliability of the mass balance approach
 - Vented and fugitive CO₂ emissions would be zero if CO₂ is of biogenic origin or comes for Direct Air Capture



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GHG Emissions from CO₂ Transport

- GHG emissions resulting from CO₂ transport by pipeline, truck or rail
 - Incorporates life cycle GHG emissions for fuel and electricity use
 - Incorporates vented and fugitive CO₂ emissions
 - If a CO₂ pipeline serves multiple sites or uses, allocate transport emissions on mass basis



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GHG Emissions from CO₂ Injection

- Separate GHG accounting equations for CO₂ injection into CO₂-EOR reservoirs and saline formations/ depleted oil and gas reservoirs
 - For CO₂-EOR, there will be emissions allocation between CO₂ sequestration and oil production
 - Emissions associated with CO₂ injection, separation and recycling are assigned to CCS on mass balance basis
 - Remaining emissions from oil and gas extraction assigned to the crude/petroleum production
 - Vented methane from CO₂-EOR assigned to crude production



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GHG Emissions from CO₂ Injection

- Incorporates life cycle GHG emissions for:
 - Fuel and electricity use
 - Vented and fugitive CO₂ emissions for CO₂-EOR; injection into depleted oil and gas reservoirs also includes vented CH₄
 - CO₂-EOR: Vented and fugitive CO₂ emissions determined using the methods for oil and gas production described in MRR
 - Saline formations/depleted oil and gas reservoirs: event-based approach for vented CO₂/CH₄ emissions & equipment count method for fugitive CO₂ emissions
 - Incorporates CO₂ leakage
 - Incorporates intentional CO₂ transfer for CO₂-EOR



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GHG Emissions from CO₂ Injection (*continued*):

- CO₂ leakage refers to the atmospheric leakage from the sequestration zone
 - Estimated using methods identified in the CARB approved monitoring plan
 - If no leak detected, CO₂ credits will be discounted by amount equal to the detection limit of the equipment



GHG Emissions from Direct Land Use Change

- Considering including GHG emissions from direct land use change (LUC) during pipeline installation and development of CO₂ injection site
 - May cause change in above-ground and below-ground carbon stock
 - Use LUC emission factors utilized in the GTAP model or similar ARB-approved land use change emission factors
- Considering omitting indirect LUC GHG emissions as they are considered small
- Staff seeks feedback on the inclusion of LUC emissions in the accounting requirements



Questions?

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Buffer Accounts & Credit
Provisions

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95486(a): Buffer Account

Rationale for creating a Buffer Account

- Safeguard mechanism against risk of credit invalidation (including unintentional reversals from CCS projects)
- Reduces invalidation risk for credit buyers

Credit contributions to Buffer Account

- Credits representing real GHG emission reductions that may not be validly claimed pursuant to prohibition on retroactive credit claims [section 95486(a)(2)]
- Credits representing the real GHG emission reduction associated with the difference in the reported CI and the verified operational CI for each FPC in a compliance year
- Net credits remaining in any deactivated LRT-CBTS accounts
- Certain % of issuance to each CCS project



Buffer Account – Stakeholder feedback

Buffer Account increases total credits in the system relative to the current rule, but does not take from any existing credit generators

In response to the preliminary discussion of the buffer account concept on 9/22/17 we heard concerns from stakeholders, including the following:

Feedback	Staff Rationale
Biofuel pathway holders who improve their operating CI score automatically lose out on any value generated between the lower operating CI and the certified CI	This occurs under the rule today (unless a new pathway is requested at a lower certified CI). The ability to request new pathways will be unaffected by the buffer account proposal
Constitute a taking of real property in violation of the Takings Clause of the U.S. Constitution	Under the rule today biofuel pathway holders do not receive any value
Would it be applied to electric vehicles?	It would be applied to EVs receiving credits under Tier 2 pathways (see discussion later today)



Concept of Buffer or Reserve in Other Programs

Forest Offset Protocol (CARB)

- Contribution based on risk rating of individual projects
- Weighted average contribution ~17% (range 10-21%)

Clean Development Mechanism (CDM)

- Fixed 5% contributions from all CCS projects
- No approved CCS methodologies or projects
- Provision to return unused credits upon project termination

American Carbon Registry (ACR)

- 10% of issued credit from CCS projects
- Can be replaced with appropriate insurance

Ontario Cap-and-Trade

- Proposed 3% contribution from of all offset projects
- Provides safeguard against invalidation risk



CCS Project Contribution to LCFS Buffer Account

A certain percentage of credits would be contributed in Buffer Account for each CCS project credit issuance. This percentage could be based on:

1. A framework for assessing risk for individual projects based on a risk-rating system
 - Equitably accounts for the potential risks associated with CCS projects across the pool of all projects
2. A fixed % based on general risk associated with a CCS project
 - Appropriate if most of the CCS projects carry similar risk profile

Staff is seeking feedback on different approaches for determining potential CCS project contribution to the buffer account.



Buffer Account – Specifics Related to CCS

Staff's suggested approach to credit invalidation and emission reversal for CCS:

- In case of emission reversal from CCS projects, credits are retired first from the buffer account up the project's historical contribution (if available)
- Next project operator is responsible to make up for any outstanding reversal (including through credit purchases)
- If any outstanding amount cannot be recovered from the project operator, then the Executive Officer retires other credits from buffer account



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Clearing Services Providers in LCFS

Requirements for clearing service providers

- Registered Derivatives Clearing Organizations with CFTC pursuant to Commodities Exchange Act
- Register account in LRT-CBTS
- Can only temporary hold credits for clearing purposes between two LRT-CBTS registered entities

Benefits

- Allow LCFS participants to participate in a more structured futures market, which could:
 - Provide more compliance flexibility in the LCFS
 - Help mitigate investment risks resulting in increased investment in low carbon fuels
 - Help further standardize credit contracts
 - Lead to better price discovery in the LCFS credit market



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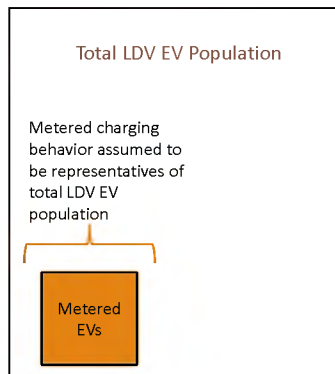
95491(d)(1)(B): Temperature Correction of Fuel Volumes for LCFS Reporting

- For all liquid fuels, reported in LCFS, the volumes must be corrected to standard conditions (60° F)
- Staff is considering proposing methods used in the U.S. EPA Renewable Fuels Standard (RFS) for temperature correction of volumes of Ethanol and Biodiesel
- For all other liquid fuels, staff is considering proposing methods required under the Mandatory Reporting Regulation (MRR)



Improving Electric Vehicle and Hydrogen Crediting

Current EV Credit Generation Structure



Metered Residential Charging:

- kWh measured
- Credits generated using CA grid-average carbon intensity (105.16 gCO₂e/MWh)

$$(CI_{std} - 105.16/EER) \times Energy_{displaced}$$

Non-Metered Residential Charging:

- kWh calculated assuming non-metered drivers behave like metered subpopulation
- ARB prorates total credit pool to utilities based on the number of LD EVs registered in their service territory

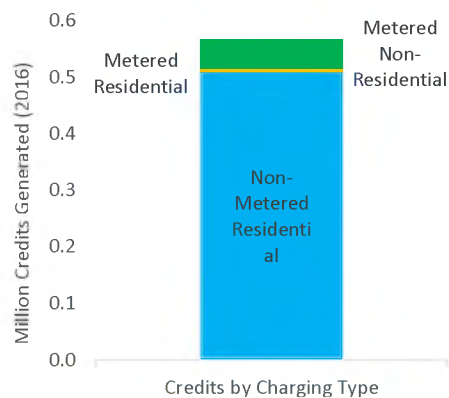
Non-Residential Charging:

- kWh measured
- Credits generated by charging providers



* Energy efficiency ratio (EER) is based on the improvement of electric vehicle drive trains compared to conventional vehicles. Currently 3.4 for LDVs.

Current State of Light Duty EV Crediting



Considering Updates

Reasons to consider updates:

- Technology and electric vehicle applications have changed
- It is difficult to co-locate renewables with distributed charging infrastructure in urban areas
- Credit structure does not currently incentivize charging when grid CI is the lowest
 - Shifting the time of charging can help further reduce CO₂ emissions

Updates under consideration:

- Updates to EERs
- More frequent updates to CA grid average CI
 - CA Grid Electricity pathway to be updated annually
- Encourage Tier 2 EV Credit Generation Pathways
 - Renewable Electricity
 - “Smart” Charging



95486(b): Update Energy Economy Ratios (EERs) for Electric Vehicles (EVs)

- Staff is considering adding EER for on-road electric motorcycles:

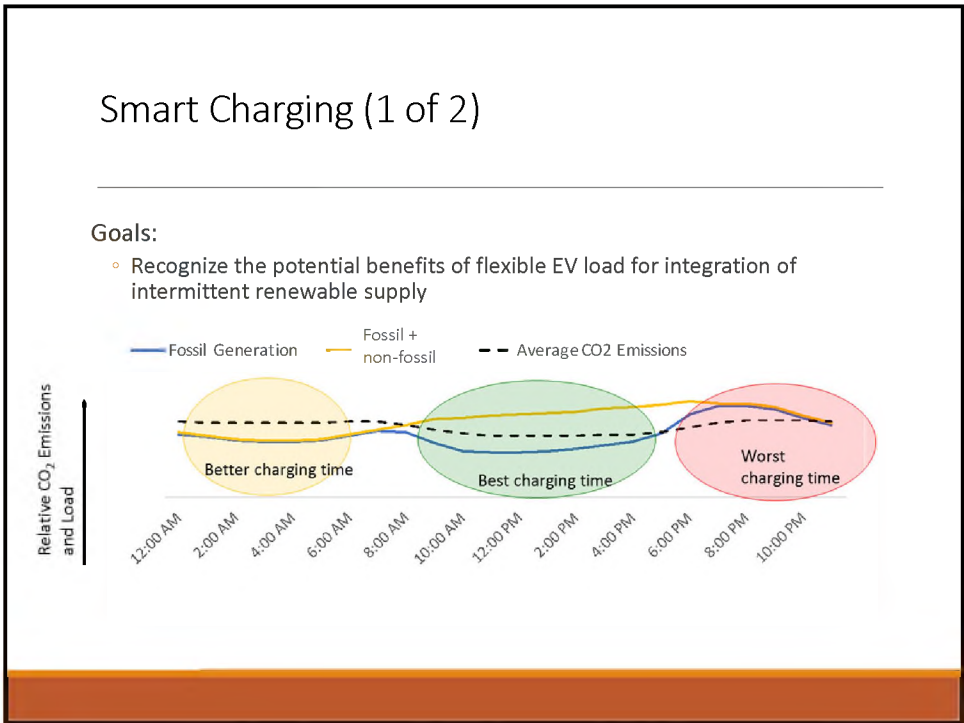
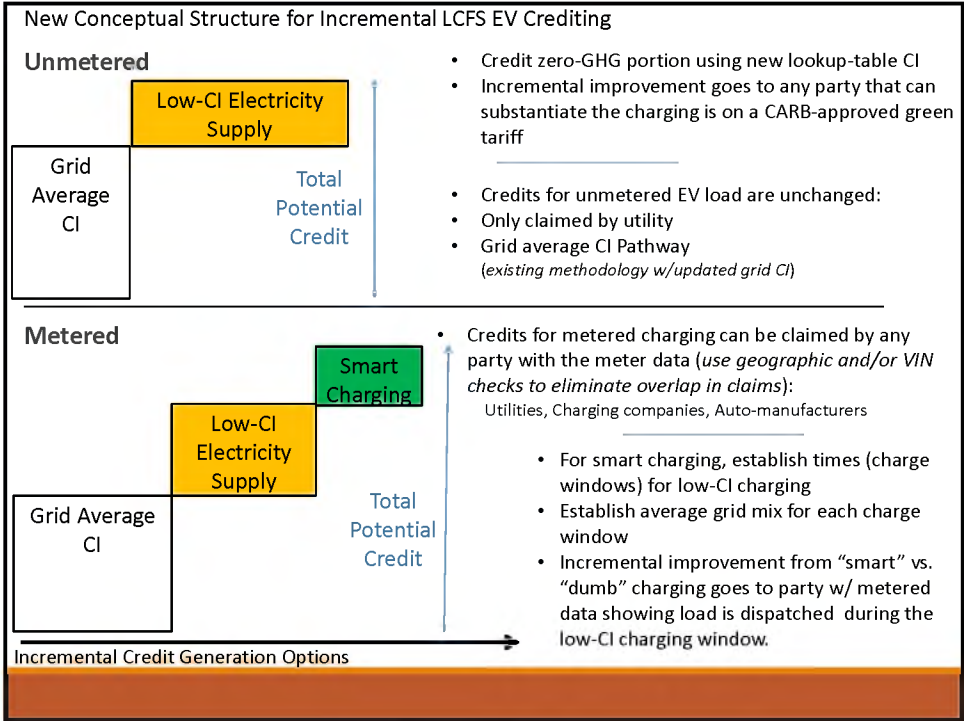
Categories	Current EER	Proposed EER
On-Road Electric Motorcycles	NA	4.4*

- Off-road motorcycles not categorized separately (could use the existing 3.4 value for light-duty BEV/PHEVs)
- Feedback received on the proposed updated EER for heavy duty EVs:

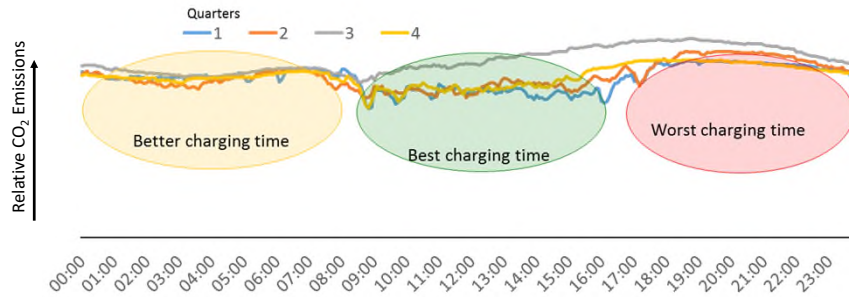
Feedback	Staff Rationale
Data selected represents “best-case” for EV’s	Staff considered data from all relevant studies and publications available
HVAC energy use not considered	Some of the EV data included accounts for HVAC. Test data for conventional fuel vehicles does not include AC load.
Duty cycle not representative of high-speed operation	Duty cycles considered is based on data reported by transit agencies and is most representative of average operational speed for all heavy duty EV types

*Source: https://www.arb.ca.gov/msprog/offroad/orrec/zem_eer_calcs_10_9_17.pdf





Smart Charging (2 of 2)



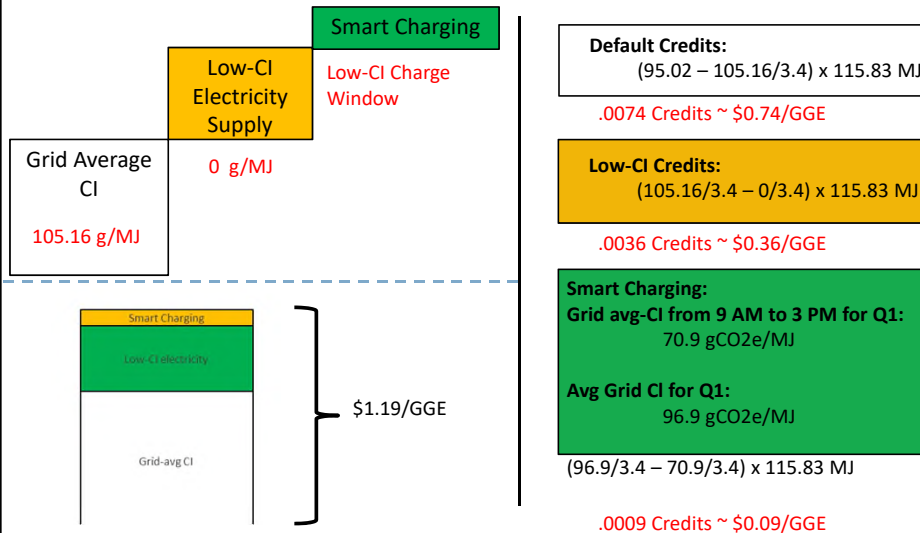
Emission Savings

Charging Window	Quarter 1 emission savings (gCO ₂ e/MJ)	Quarter 2 emission savings (gCO ₂ e/MJ)	Quarter 3 emission savings (gCO ₂ e/MJ)	Quarter 4 emission savings (gCO ₂ e/MJ)
9:00 AM – 3:00 PM	26	45.4	NA	11.4
Midnight – 9:00 AM	NA	NA	7.5	NA

Note: numbers are for illustrative purposes only

Example if implemented today

1 gallon displaced (~30 miles) Assume \$100/MT LCFS Credit price



Note: numbers are for illustrative purposes only

Other Key Questions About Smart Charging

- What source of data should be used for time-dependent grid carbon intensities?
 - CPUC Avoided Cost Model¹
 - CAISO Hourly GHG Emissions Tracking Reports²
 - Some other source?
- What timescale is appropriate to reward shifts between?
 - Multi-hour time-of-use blocks by month, hourly, real-time?
 - If multi-hour, should we consider matching to CAISO recommended TOU periods?² Utility-specific TOU periods from ratemaking?
- What showing should an applicant have to make to a verifier/CARB staff to demonstrate a claimed shift in charging timing?
 - Individual vehicles/charging FSE actual charging profile vs. baseline charging profile (“dumb charging”)
 - Profiles across all vehicles/FSEs controlled and a monitoring plan describing aggregation method across the fleet?



1 <http://www.cpuc.ca.gov/General.aspx?id=5267>

2 <http://www.caiso.com/Market/Pages/Reports/Bulletins/DailyRenewablesWatch.aspx#ghreport>

Principles behind the Incremental Proposal

- Credits may be generated by any entity with access to the relevant data
 - Parties with information about what tariff the charging occurs under (including all Load Serving Entities), or with direct access to metered charging data, are able to derive the additional benefits of the incremental structure.
- EV load on a green tariffs allow for easy accounting of non-co-located renewables
 - Ensures clarity about additionality relative to the renewable portfolio standard
 - What other options should be considered to ensure non-co-located renewables are additional to the renewable portfolio standard?
- Once EV charging is controlled using “smart charging equipment,” additional actions become available to further reduce the CI, increasing credit generation potential
 - “Smarts” can be on the vehicles or on the electric vehicle supply equipment.
 - Analogous to non-co-located but coincident w/storage concept for other electric load in Tier 2 pathways (discussed later today).



Potential use of Standards for Metered Charging Claims

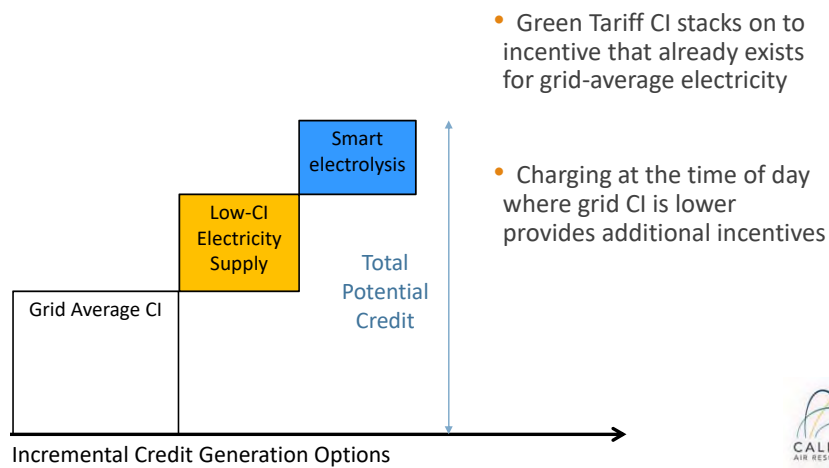
- Should metering equipment be required to meet the **ISO/IEC 15118 Standard** and **NIST Handbook 44 Section 3.40 specifications*** to qualify for credit claims?
- EV communicates with EVSE
- Allows for communication of vehicle information and Identification
- Allows for communication of, and confirmation for, charging data



*ISO 15118 specifies the communication between Electric Vehicles and the Electric Vehicle Supply Equipment. NIST Handbook 44, Section 3.40 specifies tolerances for measurements ensuring validity and accuracy in reporting.

Hydrogen

A Similar Incremental Structure Could Also Be Applied to Electrolytic H₂ Producers



Are Other Changes to LCFS Crediting Needed due to the Nascent State of Hydrogen Station Deployment?

- It may be difficult to co-locate renewables with distributed electrolysis in urban areas
- Unlike most low carbon fuels hydrogen has a separate requirement for minimum renewable content through SB 1505 (2006, Lowenthal)
 - LCFS reporting will be the mechanism to track SB 1505 compliance moving forward
- There are 29 open hydrogen stations in California currently compared to over 7,000 charging stations, and 256 CNG/LNG stations, and 120 E85 stations



Fuel Pathways

Updated Draft Models and New CI Documentation

- Updated draft Lookup Table Pathways (Table 7)
 - New draft documentation of CI calculations posted
- Updated draft Temporary FPCs (Table 8)
- Updated draft Simplified CI Calculators with accompanying draft Tier 1 CI Calculation and Operating Conditions Manual:
 - Starch/Fiber Ethanol
 - Sugar Ethanol
 - Renewable Natural Gas from Landfills
 - Biodiesel and Renewable Diesel
- Updated draft CA-GREET 3.0 model
 - New draft documentation of changes from GREET_2016



Draft Lookup Table Pathways Update

- All pathways updated with CI values determined using the draft version of CA-GREET 3.0 released for this workshop
- The draft values are not final, pending stakeholder feedback on the model
- September draft version contained an error in the North American Natural Gas to CNG (using CA grid average electricity) pathway CI values
- Draft values for hydrogen produced by electrolysis are now included
- Stakeholder feedback is requested on both the table itself and the draft documentation



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Temporary FPCs for Fuels with Indeterminate CIs

- Temporary Fuel Pathway Codes facilitate fuel reporting and credit generation for fuels while applications are being processed (or when a fuel is of unknown origin).
- The CI values are intended to be conservative.
 - The LCFS Dashboard provides annual volume-weighted averages for each fuel.
- Staff used the highest CI of each fuel type reported in 2016-2017, adjusted by +5% and rounded for convenience, to represent the highest likely emissions associated with the unknown fuel.
- Additions to the Temporary Table
 - In response to stakeholder feedback, staff has added Temporary FPCs for wastewater and food waste anaerobic digester biomethane pathways that will no longer appear in the Lookup Table.
 - Staff will add to the proposal the ability for the Executive Officer to approve new Temporary pathways without a rulemaking, similar to new Lookup pathways.



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Refinery Project Credits

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Background

- California refineries emitted about 31 million metric tons (MMT) of CO₂e in 2015
- Refineries have a set carbon intensity under LCFS and the program awards credits for refinery GHG reductions under:
 - Refinery Investment Credit Pilot Program (RICPP)
 - Renewable Hydrogen Refinery Credit Pilot Program
 - Low-complexity/low-energy-use Refinery Credit



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Overview of the existing RICPP

- Recognizes GHG reductions from refinery projects
 - Provides credits for GHG reductions at refineries that lower carbon intensities of CARBOB and diesel
 - GHG reductions estimated for the refinery as a whole based on pre-project and post-project GHG emissions
- Minimum GHG reduction threshold of 0.1 g CO₂e/MJ CARBOB and diesel
- Limit on credit generation
 - No more than 20% of refiner's annual obligation (deficits)
 - Credits can only be used towards the refiner's obligation (deficits) and cannot be sold in the market or transferred to another party



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Why amendments?

- GHG emissions reductions from a refinery investment project may be overshadowed by other changes in a refinery due to the magnitude of emissions at the "whole refinery" level
- Refinery-wide GHG changes may underestimate or overestimate reductions achieved by a refinery investment project
- Needs clarity on eligible refinery investment project types and the specific requirements for each project type (e.g., CCS protocol for CCS projects)



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Objective

- Update the program to achieve the following:
 - Develop a robust GHG accounting guideline at the process level to estimate GHG reductions from individual refinery projects
 - Simplify and streamline the credit calculation methodology
 - Identify and list specific refinery investment credit project types that are eligible



Current Staff Thinking on Project Types

Include?	Project types	Comments/Concerns
<input checked="" type="checkbox"/>	Carbon capture and sequestration	Permanence of sequestered CO ₂
<input checked="" type="checkbox"/>	On-site renewable electricity	Footprint constraints
<input checked="" type="checkbox"/>	Process fuel switching to renewable fuels	Reporting and verification
<input checked="" type="checkbox"/>	Electrification	Overlap with renewable power provisions?
<input type="checkbox"/>	Off-site renewable electricity	Possibly, if additional to RPS and with co-located battery storage?
<input type="checkbox"/>	Waste heat recovery	Credit quantification. How different units are affected? Reporting and verification. Are projects additional?
<input type="checkbox"/>	Efficient heat exchanger trains	Credits quantification. How different units are affected? Reporting and verification. Are projects additional?
<input type="checkbox"/>	Reduced fired heater duty	Credits quantification. How different units are affected? Reporting and verification. Are projects additional?
<input type="checkbox"/>	Co-generation upgrade	Credits quantification. How different units are affected? Reporting and verification. Are projects additional?
<input type="checkbox"/>	Efficient hydrogen production	Minimal scope. Renewable hydrogen covered by RHRCPP
<input type="checkbox"/>	Replacement or new installation	Lacks specificity. Better understanding required

Crediting threshold

- Transitioning from the carbon intensity threshold to a percent reduction threshold
- Eligible project should reduce GHG emissions by at least 1% from refinery-wide pre-project GHG emissions in metric tons
 - Provides equitable treatment for small and large refineries
 - Scale of this requirement is similar to prior threshold of 0.1 gCO₂e/MJ



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Credit Issuance

- Unlike for fuel pathway crediting, refinery project credits will be issued ex-post of GHG reductions using verified actual performance
 - No need for conservatism and true-up discussed during buffer account slides from earlier today, but
 - Crediting is expected to be slower (greater lag between GHG reduction occurring and credit issuance) than credits issued under fuel pathways



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Process Unit Level GHG Accounting

- The credit calculation method should rely on process unit level GHG accounting
- Refineries are complex with many interconnected process units and equipment
- Not all process units/equipment may have meters to estimate energy use and associated emissions
 - Require direct measurements using dedicated meters or utility invoices/receipts
 - In the absence of dedicated meters
 - Should engineering/modelling estimates be considered if strong justification (such as small energy use or multiple sources sharing the same energy source) and supporting evidence provided for the accuracy of estimates
 - Should this be subject to approval by the Executive Officer on a project-by-project basis?



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Credit Calculation Method

- Project-specific credit calculation method that:
 - Incorporates changes in GHG emissions (direct and indirect) due to implementation of a project
- Credit Calculation
 - Draw a project system boundary
 - Should include direct effects and at least first order indirect effects if applicable
 - Estimate pre-project and post-project GHG emissions
 - Credits (MT CO₂e/yr) = Annual Pre-project GHG – Annual Post-Project GHG
 - Credits prorated based on the volumes of CARBOB and diesel sold, supplied, or offered for sale in California



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“Pilot” Language and Prohibition on Trading of Refinery Project Credits

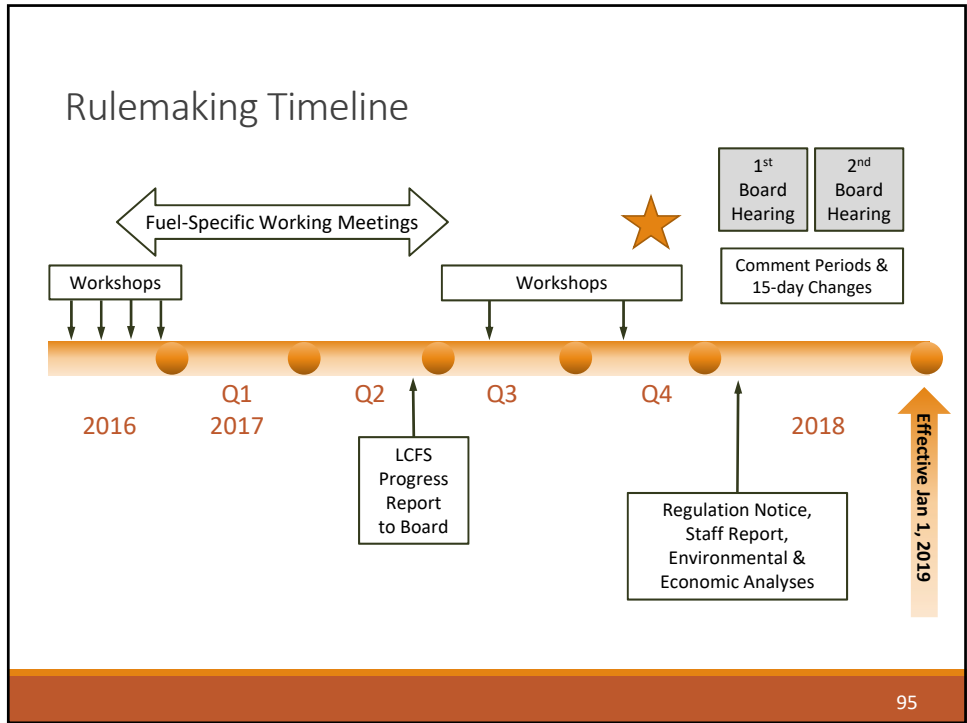
- Staff is open to removing “pilot” terminology and limitations on tradability of refinery project credits if this will help improve investment certainty
- Needs to be predicated on a clear understanding of each project-type and assurances that reductions are:
 - Real
 - Permanent
 - Quantifiable
 - Verifiable
 - Enforceable



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Final Announcements, Questions, & Open Discussion

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Update on Renewable Gasoline

- Joint statement on renewable gasoline issued by CARB and State Water Resources Control Board on Oct 24, 2017:
https://www.arb.ca.gov/fuels/gasoline/102417_rengas_jointstatement.pdf
- Clarifies that gasoline made from renewable blendstocks, and that meets CA gasoline regs and ASTM D4814, is fungible with and should be treated the same as conventional gasoline for all purposes including underground and aboveground storage tank requirements
- Mirrors joint statement on renewable diesel issued in 2013:
https://www.arb.ca.gov/fuels/diesel/aldiesel/07312013_RDjointstatement.pdf
- RD that meets CA diesel regs and ASTM D975 is fungible with and should be treated the same as conventional diesel for all purposes

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THANK YOU!

Feedback should be sent to
LCFSworkshop@arb.ca.gov

by December 4, 2017

Posted information from today's working meeting can be found at
https://www.arb.ca.gov/fuels/lcfs/lcfs_meetings/lcfs_meetings.htm

